

**REMARKS**

The specification has been amended at page 1 of the specification in order to provide a brief description of Figures 1 and 2 in accordance with 37 CFR § 1.74. Figure 1 is described in detail in the specification at, *inter alia*, page 3, line 23 to page 4, line 7. Figure 2 is described in the specification at page 5, line 30 to page 6, line 2. No new matter has been added in view of the amendment. Claims 1 and 2 are pending. In light of the following remarks, applicants respectfully request reconsideration of this application and allowance of the claims to issue.

**Obviousness Rejections under 35 U.S.C. § 103**

The Examiner asserts that claims 1 and 2 are obvious over the journal article to Dybjaer in view of U.S. Patent No. 5,167,865 to Igarashi *et al.*

Dybjaer discloses tubular reforming and subsequent autothermal reforming of natural gas. The tubes of the tubular reformer are filled with catalyst (pg. 88). Tubular reforming can be used alone or in combination with other reforming steps such as adiabatic pre-forming or secondary reforming (pg. 97). In the case of adiabatic pre-forming, the process is carried out in a fixed bed adiabatic reactor loaded with highly active reforming catalyst (pg. 99).

Igarashi *et al.* discloses the deposition of a catalyst on a gas-impermeable boundary member. Figures 1 and 2 provide examples of the boundary members to be deposited with the catalyst. Igarashi *et al.* discloses that the boundary members can be stacked in a reaction vessel (column 4, lines 33-56).

The Examiner asserts that it would have been obvious to one of ordinary skill in the art to replace the catalyst filled tubes or packed catalyst bed of the first and second reactors of Dybjaer with a reactor having a thin film of the catalyst supported on the walls of the reactor as taught by Igarashi *et al.* Applicants respectfully traverse the rejection.

First, there is no teaching or suggestion in Dybjaer to apply or use a thin film of reforming catalyst in any of the reactors. Dybjaer only directs the skilled artisan to use tubes

filled with catalyst or packed catalyst beds. Indeed, the Examiner has acknowledged that Dybjaer does not disclose reactors having a thin film of catalyst on the wall of the reactor (page 3, lines 19 and 20 of the Office Action). In the absence of any teaching or suggestion in Dybjaer to apply a thin film or reforming catalyst to the inner wall of the reactor, the present invention as recited in claims 1 and 2 would not have been obvious in view of Dybjaer alone or in combination with other prior art.

Assuming, *arguendo*, that there was motivation in Dybjaer to incorporate the boundary members disclosed in Igarashi *et al.* in the reactors of Dybjaer, the present invention as recited in claims 1 and 2 would still not be produced. Igarashi *et al.* is only concerned with producing boundary members with a catalyst deposited on the member in order to stack the members into a reactor. The incorporation of the boundary members disclosed in Igarashi *et al.* into the reformer of Dybjaer does not produce the present invention, which involves the use of a thin film of catalyst on the inner wall of the reactor. Although Igarashi *et al.* discloses that a catalyst can be deposited on the surface of the boundary member, there is no motivation or direction in Igarashi *et al.* to deposit the catalyst on the inner surface of a reactor tube. Indeed, Igarashi *et al.* addresses the problems associated with a reactor wall having a catalyst deposited on the inner wall of the reactor (*see* column 1, lines 48-56). In particular, according to Igarashi *et al.*, the tube reactor does not possess enough surface area of the catalyst required for the reaction. Igarashi *et al.* addresses this problem by producing a stacked system having catalyst deposited on the system.

Therefore, based on the teachings of Igarashi *et al.*, one of ordinary skill in the art would not have been motivated to apply or use a thin film of catalyst on the reactor wall in the apparatus of Dybjaer to produce the present invention. Therefore, the present invention would not have been obvious to one of ordinary skill in the art.

Additionally, neither Dybjaer or Igarashi *et al.* recognize the benefits of using a thin film of catalyst on the inner wall of a reactor, which are discussed in the specification at, *inter alia*, page 2, line 26 to page 3, line 19. In summary, the use of a thin film of catalyst provides more

efficient heat transport during the reaction. One result of the efficient heat transport is that the temperatures of the inner tube and wall and the catalyst are almost identical. Additionally, the tube thickness can be reduced, which makes the temperature difference between the inner and outer side of the reformer tube smaller. There are numerous advantages with this reduced temperature gradient between the inner and outer surfaces of the tube. First, a lower outer wall temperature is desirable since it prolongs the lifetime of the tube. Additionally, the pressure drop is much lower using a thin film of catalyst on the inner wall of the reactor, which enables the use of reactors of non-traditional shapes (e.g., tubes with small diameters) that have a longer lifetime, more temperature tolerant, and require less material to produce the tube. Second, a high catalyst temperature can be achieved, which increases the rate of reaction in the tube. Finally, the amount of catalyst is reduced when a thin film of catalyst is applied to the inner wall of the reactor.

Based on the numerous advantages of the present invention coupled with the arguments presented above, the present invention would not have been obvious in view of the combined teachings of Dybjaer and Igarashi *et al.* Applicants respectfully request the rejection be withdrawn.

The Examiner asserts that claims 1 and 2 are obvious over U.S. Patent No. 5,932,141 to Rostrop-Nielsen *et al.* in view of the journal article to Dybjaer. The Examiner asserts that Rostrop-Nielsen *et al.* is prior art under 35 U.S.C. § 102(e). In order to expedite prosecution, enclosed is a Terminal Disclaimer and Declaration under 37 C.F.R. § 1.130(a). In view of the Terminal Disclaimer and Declaration, Rostrop-Nielsen *et al.* is no longer prior art under 35 U.S.C. § 102(e); therefore, the obviousness rejection is no longer valid. Applicants respectfully request the rejection be withdrawn.

### **Double Patenting Rejections**

The Examiner has rejected claims 1 and 2 as being unpatentable under obviousness-type double patenting in view of the following documents:

**ATTORNEY DOCKET NO. 07089.0010U1**  
**APPLICATION SERIAL NO. 09/743,528**

1. claims 1-6 of U.S. Patent No. 5,932,141 to Rostrop-Nielsen *et al.* in view of the journal article to Dybjaer;
2. claims 1-4 of copending application no. 09/743,530 in view of the journal article to Dybjaer and further in view of U.S. Patent No. 5,167,865 to Igarashi *et al.*;
3. claims 1-9 of copending application no. 10/667,389 in view of the journal article to Dybjaer and further in view of U.S. Patent No. 5,167,865 to Igarashi *et al.*;
4. claims 1-8 of copending application no. 10/667,392 in view of the journal article to Dybjaer and further in view of U.S. Patent No. 5,167,865 to Igarashi *et al.*; and
5. claims 1-7 of copending application no. 10/668,295 in view of the journal article to Dybjaer.

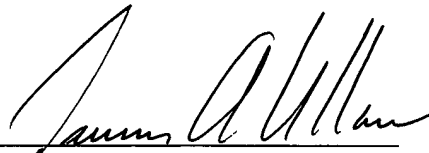
In order to expedite prosecution, enclosed are Terminal Disclaimers for U.S. Patent No. 5,932,141 and copending application numbers 09/743,530; 10/667,389; 10/667,392; and 10/668,295. Applicants respectfully request the rejections be withdrawn.

Pursuant to the above remarks, reconsideration and allowance of the pending application is believed to be warranted. The Examiner is invited and encouraged to directly contact the undersigned if such contact may enhance the efficient prosecution of this application to issue.

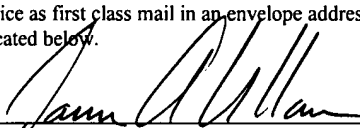
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A Credit Card Payment Form PTO-2038 authorizing payment in the amount of \$420.00 for the submission of the two-month extension of time is enclosed. This amount is believed to be correct; however, the Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Respectfully submitted,  
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<b><u>CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8</u></b>	
I hereby certify that this correspondence, including any items indicated as attached or included, is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date indicated below.	
 Lawrence A. Villanueva	<u>08/24/04</u> Date

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